Contact persons:
Francois Swanepoel
& Sunette Laurie

Email: SwanepoelF@arc.agric.za; SLaurie@arc.agric.za

SPECIFICATIONS FOR GLASSHOUSE STRUCTURES B5

FEBRUARY 2025

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

This chapter is discussed under the following headings:

- Introduction and background
- Project location
- Project objective
- Purpose of the report
- Structure of the report.

1.1.INTRODUCTION AND BACKGROUND

The Agricultural Research Council (ARC) of South Africa has identified a need to enhance its research facilities. With a vision to bolster the nation's agricultural research capabilities, the Council has initiated an RFQ (Request for Quotation) for the comprehensive refurbishment and construction of this glasshouse complex. This glasshouse, spanning an area of about 200 m² , is pivotal for myriad research purposes. The project emphasises modern, energy-efficient solutions, from advanced cooling and heating systems to computerised control setups. With water sustainability and solar energy utilisation also on the agenda, the Council's objective is clear: to cultivate state-of-the-art, eco-conscious research environments that drive agricultural innovation forward.

1.2. PROJECT LOCATION

The project is situated at the Vegetable Industrial and Medicinal Plants Institute of the Agricultural Research Council (ARC-VIMP) located on the R573 KwaMhlanga/Moloto Road near Roodeplaat in Pretoria, South Africa.

FIGURE 1-1: SITE LOCATION

1.3. PROJECT OBJECTIVE

The primary objective of this project is to refurbish and construct a state-of-the-art glasshouse complexes for the Agricultural Research Council of South Africa. This enhancement aims to bolster the nation's agricultural research capabilities by creating modern, energy-efficient, and eco-conscious research environments.

1.4. PURPOSE OF THE REPORT

The purpose of the detailed specification is to clearly outline greenhouse specific requirements and materials, ensuring that there is a common and clear understanding of the greenhouse components and their functional requirements. The specification will aid the tenderer to price the design build project and to execute the design on appointment.

1.5.STRUCTURE OF REPORT

The report comprises the following sections:

- Section 2: Greenhouse B5- design specifications
- Section 3: General Specifications
- Section 4: Name Boards
- Section 5: Pricing Data
- Drawing

2. GREENHOUSE B5 - DESIGN SPECIFICATIONS

This chapter will focus on the B5 design specifications. The design specifications for the B5 greenhouse will be subdivided into ten (10) sub-sections which include:

- Overview
- Greenhouse structure
- Structural specifications
- Cladding
- Cooling, heating and climate systems
- Climate control
- Growing systems
- Water systems
- Electrical systems
- Equipment

2.1. OVERVIEW

Greenhouse B5 is an existing greenhouse structure with central hallway which allows for access to each of 10 identical compartments and an additional space marked as “B5.11 – OFFICE”.

The greenhouse will be used as a stress- testing greenhouse facility. The external structure for greenhouse B5 will remain unchanged, with the exception of the replacement of the existing top structure for the greenhouse. Additionally, the corridor ceiling will need to be replaced. The office area is excluded and will not require any modifications besides the installation of a door parallel to the corridor entrance.

FIGURE 2-1:SIDE VIEW OF THE CURRENT B5 GREENHOUSE

FIGURE 2-2: FRONT VIEW OF THE B5 GREENHOUSE

2.2.GREENHOUSE STRUCTURE

2.2.1. DIMENSIONS

Growing Area: 10 Bays (6.3m x 2.5m) per bay – Existing

Corridor: 1 Corridor (24.4m x 2.98m) – Existing

Total Area: 208 m ² - Existing Structure

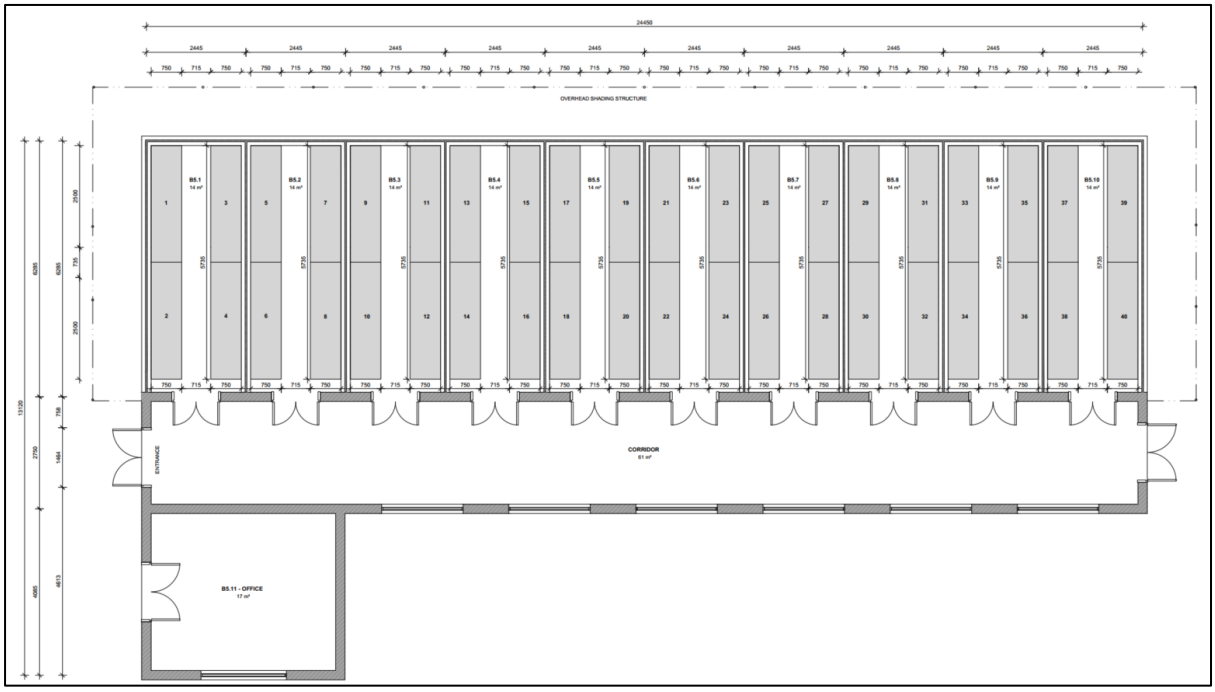


FIGURE 2-3: BASIC LAYOUT FOR B5 GREENHOUSE (SEE ADDENDUM A DRAWINGS)

2.2.2. STRUCTURAL SPECIFICATIONS

2.2.2.1. FOUNDATIONS

- Existing – No action required.

2.2.2.2. FLOORS

- Existing – No action required.

2.2.2.3. DRAINAGE

Greenhouse B5 will require an upgrade to the drainage channel to enable the construction of separate outlets into the channel from each of the compartments B5.1 to B5.10. The channel will be located in the corridor just outside the door of the compartments.

A new Channel must be constructed in the corridor. Each compartment will flow into the new channel.

See paragraph: channel.

FIGURE 2-4: EXISTING DRAINAGE CHANNEL

2.2.2.4. GUTTERS

- Existing – No action needed.

2.2.2.5. DOORS

See paragraph Locks and doors.

- lockable entrance door – **corridor (Western side)**
    - Existing door to be removed & door reveals to be replaced with:
    - One x aluminium frame and aluminium leaf double door to the preparation of the corridor Western Side (No glass)

- One lockable door – corridor **(Eastern side)**
    - One aluminum frame and double-leaf door for the preparation area on the eastern side of the corridor.
    - Push bar emergency exit system.

- Compartment **B5.1 – to B5.10** to be replaced with aluminium single frame.
    - 10 x aluminium frame and single aluminium leaf double door (Glass in aluminium door frame is allow)
    - Sealed single aluminium frame and leaf door that opens towards the corridor.
    - With standard lock and key system as supplied by door manufacturer.

- Office door at office Main Entrance (Westen side of the office wall)
    - New opening in wall for standard door and frame
    - Sealed single aluminium frame and leaf door that opens towards the corridor.
    - One new safety gate: See paragraph: Safety gate

2.2.2.6. WINDOWS

- All existing windows inside the corridor to be re-furbished from openable sections to fixed sections.
- All damaged glazing in corridor to be replaced with 6mm glass.

2.2.2.7. WALLS

- Removal of Existing Doors:
    - All doors situated between compartments will be removed to facilitate the installation of new partitioning.
- Construction of new walls:
    - **Lower Section**: The lower section of the new partitions will be constructed using plastered face brick walls to match and integrate into the existing walls.
    - **Upper Section**: Above the brick base, an aluminium frame will be installed, which will hold the polycarbonate panels extending to the ceiling

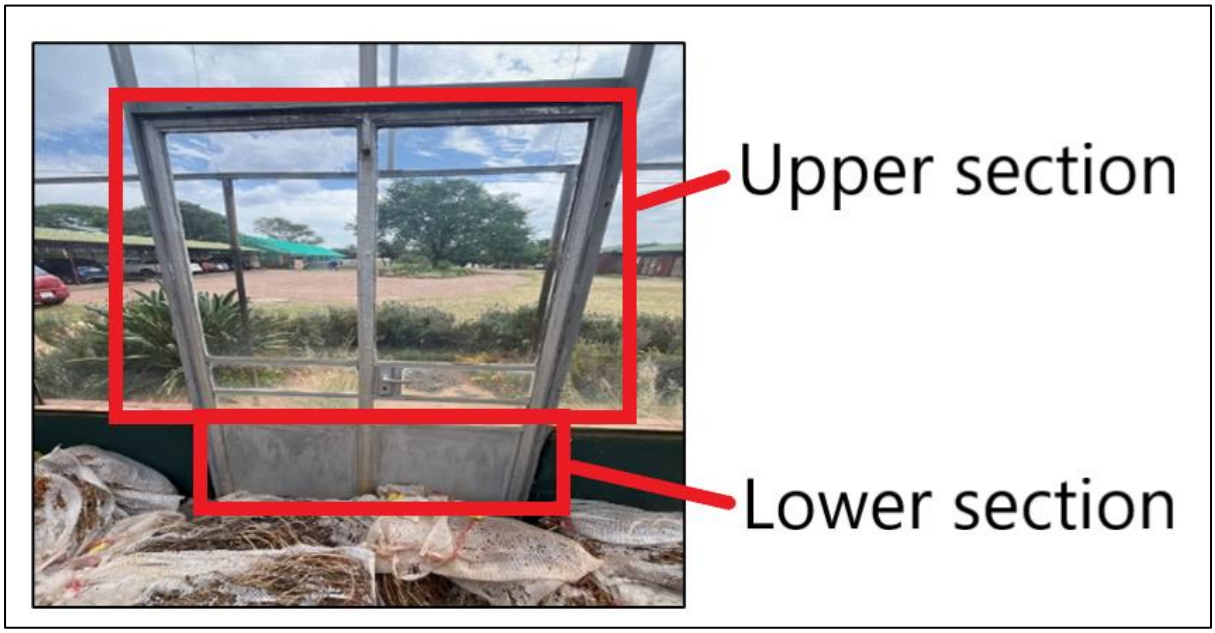


FIGURE 2-5: EXISTING SEALED COMPARTMENT DOORS

2.2.2.8. FRAME OF THE GREENHOUSE ROOF STRUCTURE

- Frame to be replaced with aluminium that is compatible with Polycarbonate glazing.

TABLE 2-1: B5 GREENHOUSE STRUCTURE SPECIFICATIONS

COMPONENT	TYPE
Greenhouse Structure	Gable Roof
Size	As per approved greenhouse shop drawings (close as possible to match existing) Existing height: • Eave Height – 2.4m • Ridge Height – 3.58m • Gable End Height – 1.18m
Material	Aluminum according to EN ISO 12944-2 Category C1-C3

FIGURE 2-6: EXAMPLE OF A GABLE STRUCTURE OF A GREENHOUSE

2.3.CLADDING

The cladding for this greenhouse will include the following components:

- Walls and Roofs
- External hail protection
- Corridor Ceiling

2.4.WALLS AND ROOFS

All walls and roofs need to provide a durable, thermally insulating, and light-transmitting covering for the greenhouse roof and gable fronts that facilitates optimal plant growth and protection from external elements.

- All existing glass side walls and roof panels to be removed and replaced with multi -wall polycarbonate sheets.
- Multi -wall polycarbonate (PC) sheets (6 -10mm) fixed to purpose made aluminium frame with end caps for sealing of top and bottom edges to keep moisture and debris out.
- Customized to fit the specific measurements of the greenhouse structure.
- Dimensions will be finalized based on detailed shop drawings.
- Panels will be pre-cut to fit the designated roof and gable areas, including allowances for thermal expansion and contraction.
- All walls will need to be multi-wall polycarbonate (PC) sheets (6 -10mm)
- Ensure all panels are adequately sealed at both ends.

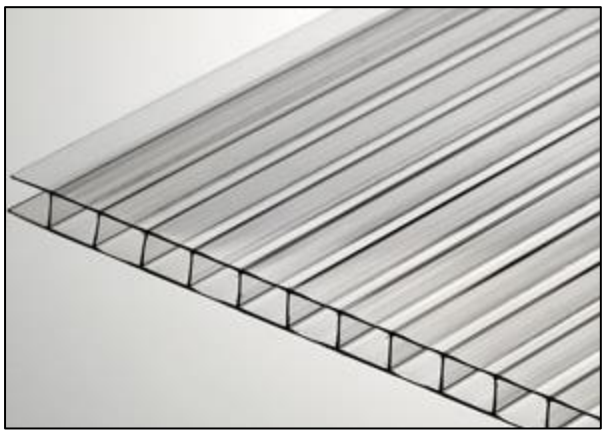


FIGURE 2-7: MULTIWALL POLYCARBONATE SHEET

2.5.EXTERNAL HAIL PROTECTION

- External hail protection will be needed to ensure all polycarbonate panels are protected.
- There is an existing frame structure
- Retain and adjust the hail structure
- Hail net protecting the roof and side walls for compartments B5.1 – B5.10 constructed from galvanized steel mesh, similar in durability and design to existing wire.

- Provide galvanized welded mesh with a 25.4mm x 12.7 mm aperture and 1.5 mm thickness as a separate line item for all hail protection structures.

2.6.CORRIDOR CEILING

- Replacement of damaged corridor ceiling in accordance with dimensions of the existing corridor ceiling with plastic ceilings and corniches.
- See paragraph: PVC ceiling material.

2.7.COOLING, HEATING AND CLIMATE SYSTEMS

The cooling, heating and climate systems can be broken down into the following:

- Heating and cooling
- Ventilation
- Humidification

2.7.1. HEATING AND COOLING

- HVAC system will be dual-function units capable of both heating and cooling.
- Each compartment must be able to control heating and cooling independently; should be able to achieve between 10 and 40°C, suitable for the specific location and independent of external climate conditions and factors and adjacent compartments.
- See Paragraph : Climate control system

2.7.2. VENTILATION

- No Ventilation will be required as compartments will need to be sealed

2.7.3. HUMIDIFICATION

- Foggers and Misters
  - Each compartment will be equipped with foggers and misters capable of delivering a fine spray to achieve and maintain uniform humidity levels.
- Control and Integration
  - The humidification equipment will need to be fully integrated with the greenhouse's centralized computerized control system. The integration will allow for automated adjustments based on real-time humidity data.
- Relative Humidity Levels
  - The system will need to maintain relative humidity levels between 60% and 85% within each compartment, suitable for the specific location and independent of external climate conditions and factors and adjacent compartments.

- Relative humidity levels must be able to turn off completely when needed.

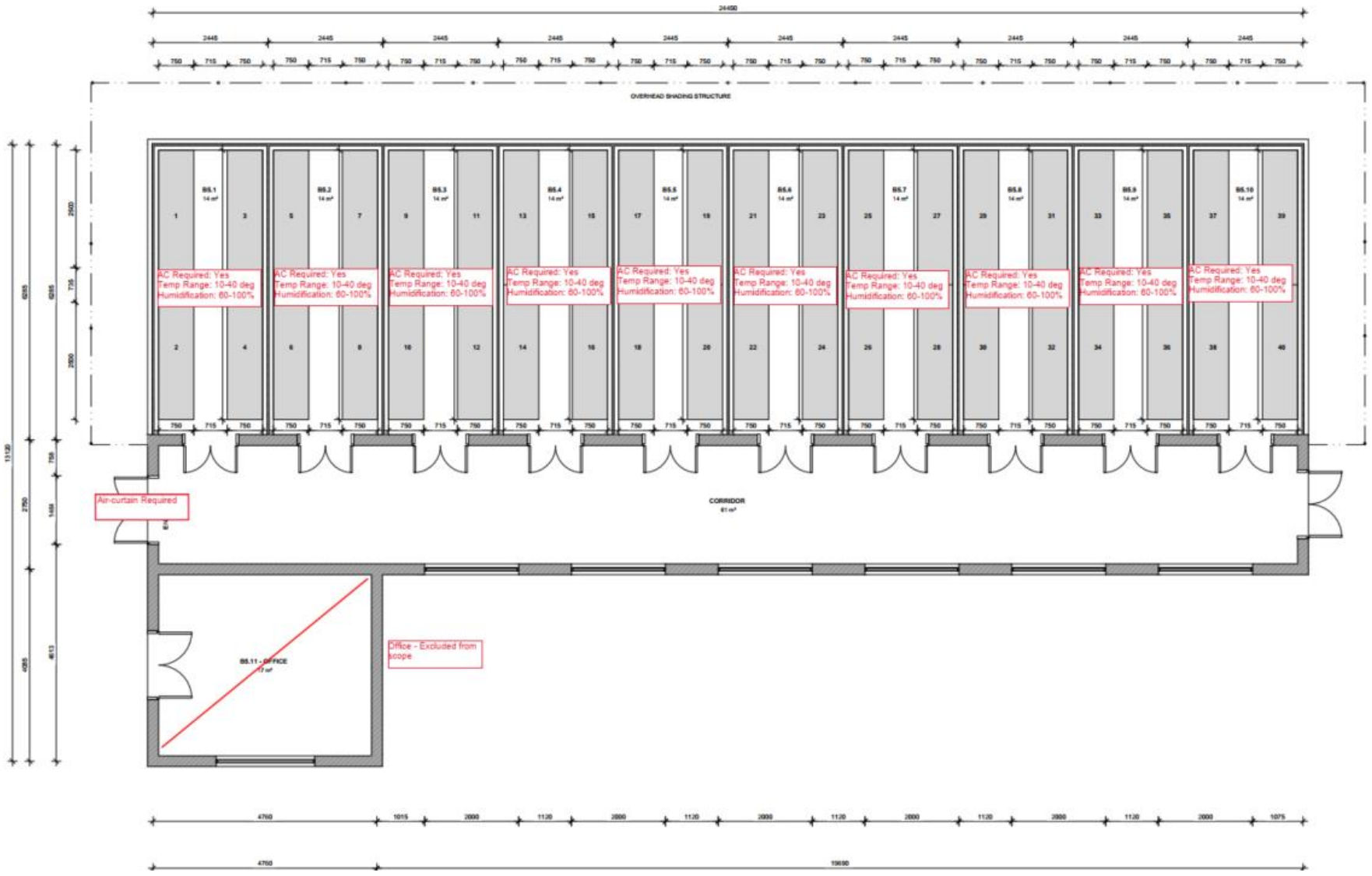


FIGURE 2-8: GREENHOUSE B5 – HVAC

2.8. CLIMATE CONTROL SYSTEM

Capable of achieving and maintaining temperatures from as low as 10°C to as 40°C, suitable for the specific location and independent of external climate conditions and factors and adjacent compartments.

- See Paragraph: CLIMATE CONTROL SYSTEM

2.9. GROWING SYSTEMS

Growing systems for the B5 greenhouse include:

- Tables
- Trellis Support

2.9.1. TABLES

See paragraph: Steel tables.

The B5 greenhouse will need to consist of moveable steel tables which are intended to support both taller and shorter type plants per specific compartment as detailed below:

- Compartment B5.1 to B5.6 will consist of moveable steel tables
  - 4 of 0.75 (w) x 2.8 (l) x 0.5) (h) for taller type plants
- Compartment B5.7 to B5.10 will consist of moveable steel tables
  - 4 x (0.75 x 2.8 x 0.8) (w*L*h) for shorter type plants

2.9.2. TRELLIS SUPPORT

See paragraph: Trellis support system.

2.10. WATER SYSTEMS

The water systems for the B5 greenhouse will consist of:

- Water Source
- Irrigation
- Fertigation
- Service Water

2.10.1. WATER SOURCES

The water supply to the greenhouse will need to tie into existing water reticulation system with the need for alternative water supply to provide an auxiliary water supply during potential interruptions of primary water supply.

See paragraph: Alternative water supply

2.10.2. IRRIGATION

- Dripper irrigation system

- See paragraph: Irrigation

2.10.3. FERTIGATION

- Manual fertigation will be used to deliver nutrient solutions to the plants.

2.10.4. SERVICE WATER

- See paragraph Service water.

2.11. ELECTRICAL SYSTEMS

2.11.1. GENERAL

- All equipment must be equipped with Surge arresters and lightning protection
- See paragraph: General information on Electrical systems

2.11.2. GREENHOUSE

- Excavation of all materials for trenches, concrete capping, backfill, compact and dispose of surplus material as required from Substation F, to SDB2A
- Removal and disposal of existing equipment, cabling, and all associated existing electrical infrastructure from point of supply in Substation F, to SDB2A, including but not limited to Kiosk B and SDB2A with associated cables and switchgear.

FIGURE 2-9: SUBSTATION F & GREENHOUSE B5 KIOSK

- Installation of the following:
  - Appropriately sized three phase circuit breakers in LV panel in substation F based on expected demand.
  - Low voltage cables installed in trenches, including.
  - Cable terminations
  - Bare copper earth conductors
  - Cable ends for copper earth conductor including glands, lugs and connections.

- All other components as required for supply from Substation F to the B5 distribution kiosk (Kiosk B).
- 1 Kiosk with lockable doors complete with all necessary components, including, but not limited to busbars, switchgear, internal wiring, blanking plates, labelling etc. The kiosk is to be connected to the newly installed Sub DB in the passage (SDB2A). Kiosk to be in the same position as the existing kiosk to be removed.
- PVC Insulated Conductors
- PVC Insulated Earth Conductors
- Galvanised screwed conduit including bending, jointing, short lengths, draw boxes, couplings, bends, saddles, hospital saddles and wastage conduit ends.
- Low hanging Vaporproof grow light fittings equipped with RGB and white LEDs for each compartment including wiring and connection to timer
- Appropriately sized socket outlets and isolators for the applicable HVAC installation and PLC box.
- Install a three phase electrical meter to measure electrical consumption for the green house complex, include phase failure and surge arrestor for protection
- Wall mounted lockable box complete with all equipment associated with a PLC system for each compartment.

2.11.3. CORRIDOR

- Waterproofing of roof, replace ceilings and paintings of walls
- Removal of all existing, dilapidated electrical components and equipment.
- Installation of the following:
  - Socket outlets including wiring.
  - Lighting including wiring.
  - Conductors and earth conductors required for lighting and socket outlets.

2.12. EQUIPMENT

The equipment for the B5 greenhouse includes the following components

- Footbaths
- Air curtains
- Cabinets
- Basin
- Corridor Tables

2.12.1. FOOT BATH

See paragraph: Foot bath.

2.13. AIR CURTAIN

See Paragraph Air curtain

2.13.1. STEEL CABINETS

- 2x Steel cabinets needed in the corridor for general storage. Equipped with shelves and lockable doors to secure contents.
- Heavy duty steel cabinets of 20pprox.. 730 litres or similar.

FIGURE 2-10: HEAVY DUTY STEEL CABINETS

2.13.2. BASIN

A single centrally located washing basin within the corridor/passage. Used for washing of tray and pots and should include faucets (hot and cold) with an inline water heater system.

- Material
  - Stainless steel for its durability, resistance to rust, and ease of cleaning.
- Dimensions
  - Adequately sized to accommodate the largest trays and pots used in the greenhouse. Typical dimensions might be 120 cm in length, 60 cm in width, and 40 cm in depth.
- Depth

- Sufficient depth to prevent splashing and handle large volumes of water, usually around 40 cm.

- Placement
  - Centrally located in the corridor. The basin should be securely mounted to the floor to prevent movement during use and equipped with a high-capacity drain to prevent clogging.

2.13.3. CORRIDOR TABLES

The remaining space in the corridor should be filled with tables that resemble those shown in the figure below.

FIGURE 2-11: EXAMPLE OF CORRIDOR TABLES

3. GENERAL SPECIFICATIONS

3.1.ELECTRICAL SYSTEMS

3.1.1. GENERAL INFORMATION ON ELECTRICAL SYSTEMS

- **All equipment must be equipped with Surge arresters and lightning protection**
- Contractor to provide as-built drawings based on the completed installation in AutoCAD 2023/4 as well as PDF formats. Hard copies shall form part of the handover documents.
- Contractor to provide 3 sets of handover documentation that includes all equipment datasheets, guarantees and warrantees, operation and recommended maintenance manuals for all equipment and the installation.
- Issuing of an electrical certificate of compliance to achieve occupation for each installation is required
- All equipment and products used for the electrical installation shall be SABS approved and shall bare the SABS stamp of approval. This includes but not limited to, circuit breakers, light switches, socket outlets, isolators, wiring

and cables, conduit and accessories, and light fittings. Non-compliance of this clause will result in rejection of the installation and all costs pertaining to rectifying the installation shall be born to the contractor.

- All designs and installation shall be done in accordance to the following standards:
    - SANS 10142-1: The wiring of premises Part 1: Low voltage installations
    - SANS 10114-1: Interior Lighting: Artificial lighting of interiors
    - SANS 10114-2: Interior Lighting: Emergency lighting
    - SANS 10389-1: Artificial lighting of exterior areas for work and safety
    - SANS 10389-2: Exterior security lighting
    - SANS 10400: The application of the National Building Regulations
    - SANS 204: Energy Efficiency in Buildings
    - SANS 10313: Protection against lightning
    - SANS 61024: Protection of structures against lightning
    - All municipal regulations pertaining to building codes and health and
    - safety requirements
    - South African Occupational Health and Safety Act (Act 85 of 1993).

3.1.2. LIGHTS

Photo indicates the Growth and normal LED light on each fitting

- Lights must be mounted underneath the trellis system.
- All lights must me IP 65 rated (Dust tight & protecting from water jets in any direction)
    - Led lights: Similar or equal to
        - http://a365.acdc.co.za/Images//spec/LEDT8PG-A3FR.pdf
        - Similar or equal to: https://www.acdc.co.za/pages/led-grow-lights
- Complete with T8 fittings, switch etc.

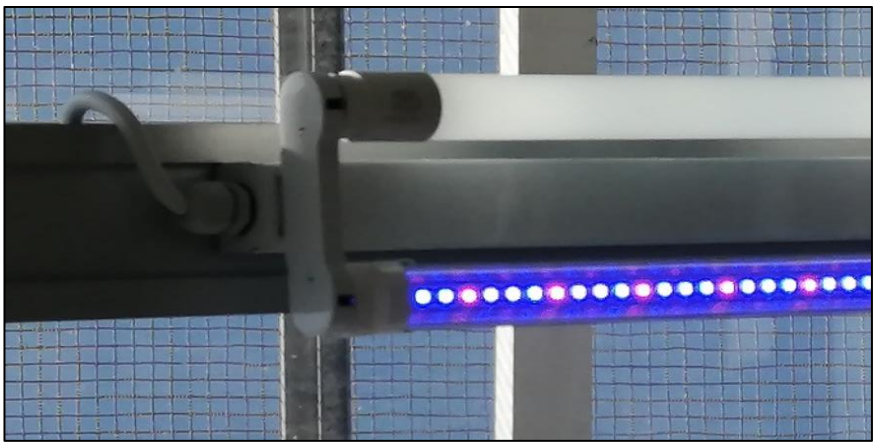


FIGURE 3-1: EXAMPLE OF GROWTH LIGHTS (NOTE: THIS EXAMPLE IS NOT IP65 RATED)

Light switches for grow lights

- 24 hour geyser timer with 8 programs mounted to wall plate

- Timer must be mounted into wall switch plate
- All wire must be in plastic trunking
- 24 hour geyser timer with 8 programs mounted
- Timer front must flash with wall (Not protruding)
- 2 lever switch plate. (1) activate lights with timer (2) activate lights

FIGURE 3-2: LIGHT AND TIMER CONFIGURATION

3.2.CHANNELS

The channel final dimensions must be minimum 300mm wide and 300mm deep to enable a clear level difference between the channel invert and the inlet from the different compartments. This will prevent backflow and possible cross contamination between the compartments if there is a blockage in the channel. The channel is also covered by a galvanised steel grid to prevent tripping and enable access into the compartments with trollies. The typical channel cross section can be seen in Figure 3-3

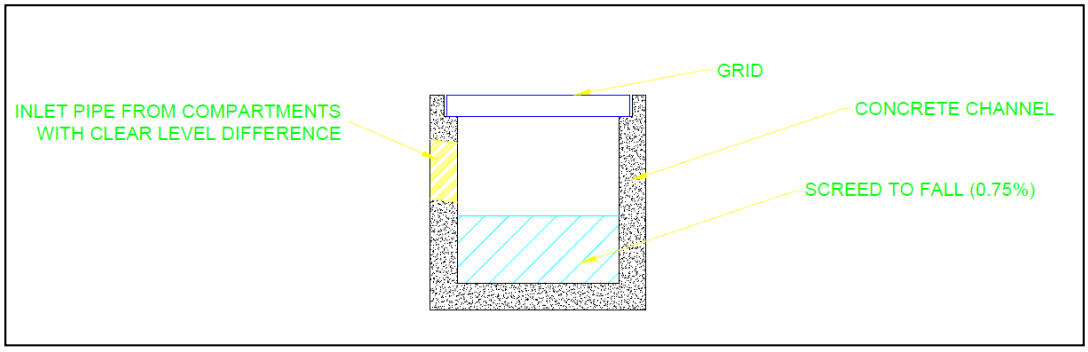


FIGURE 3-3:TYPICAL CHANNEL CROSS SECTION

3.2.1. CHANEL CONSTRUCTION

- Floor of channel must be 80mm thick 20 Mpa ready-mix concrete
- Sides must be build up with bricks, mortar with and plaster or 80mm cast concrete.
- Slope of the channel must be minimum 1:40

3.2.2. GRID OVER CHANNEL

- Heavy duty Mentis steel grating (see picture below)
- Mentis grading must be framed in 40 x 40 x 5 angle iron, the frame must be anchor in to the brick or concrete walls

- Material: **Galvanized** Heavy duty steel grating and frames.

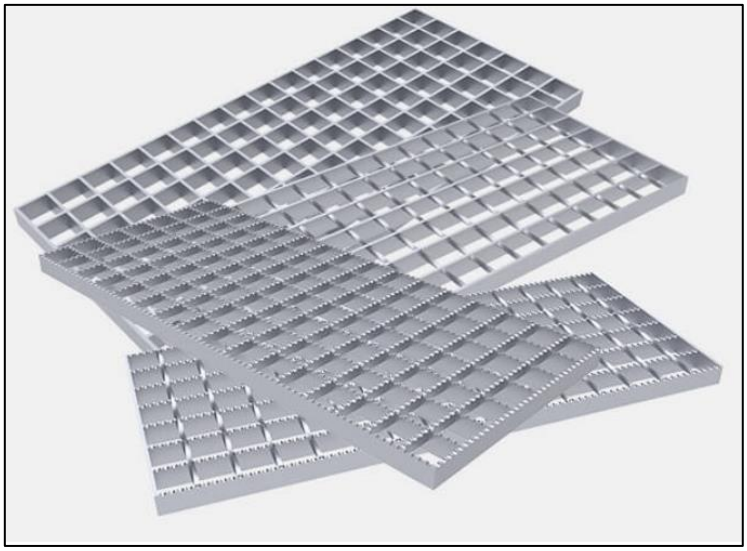


FIGURE 3-4: GRID OVER CHANNEL

3.3.CLIMATE CONTROL SYSTEM

The climate control system must be designed to provide precise regulation of environmental conditions within each compartment of the greenhouse independently and consist of the following:

- Remove remains of old cooling/heating systems
- All HVAC must be digitally controlled
- A centralized, computerized system will manage and regulate the climate within each compartment of the greenhouse
- The system will need to continuously monitor the temperature and humidity levels in each compartment using a minimum of 3 sensors, ensuring that the environmental conditions are within the specified parameters.
- Automated controls will adjust heating, cooling, and humidity based on real-time data received from the sensors.
- HVAC system will be dual-function units capable of both heating and cooling.
- Design parameters of ± 3500 Btu/hr/m²
- Capable of achieving and maintaining temperatures from as low as 10°C to as 40°C as specified for each of B5, suitable for the specific location and independent of external climate conditions and factors and adjacent compartments.
- Capable of multiple settings per day e.g. Day and night setting
- Each unit must have the capability to independently control the temperature in its designated compartment, without affecting adjacent areas.

- Integration with a centralized computerized control system for precision management.
- Manufacture and install purpose made galvanized ducting internally insulated.
- 2x washable filter sets per unit in return ducting
- Supply and install a double deflection supply air grill per unit
- Supply and install one return air grille per unit.
- The air conditioners control unit will be housed in a steel metal electrical enclosure (IP65) with all the relevant switch gear to control the AC units, one metal electrical enclosure per compartment
- Supply and install new electrical cables from the distribution board.
- All cables must be in galvanized steel trunking or galvanized wire trays
- Screens may be installed to aid temperature control.

FIGURE 3-5: ELECTRICAL BOX

3.3.1. SMS WARNING SYSTEM

- Alarming system that will send a warning if temperatures are out of range.
- The system must be accessible via cloud, desktop, and mobile platforms, and must utilize the existing internet infrastructure within the office area. The contractor is required to extend this existing internet service (Wi Fi) to ensure comprehensive coverage throughout the entire greenhouse
- SMS sim card and pre-loaded data to be able to send all warning messages for 1 year

3.3.2. ELECTRICITY METER

- 3 Phase electricity meter to measure the electricity consumption off each green house complex

3.3.3. CONCRETE PLINTH OF AC UNITS

- Al AC units must have a concrete plinth that is a minimum of 0.5 meter larger on al 3 sides of the AC unit. The 4 th side is facing the glasshouse.
- Slightly slope away from the structure (1:100)
- Compacting of soil. Minimum of two (2) successful Dynamic Cone Penetrometer (DCP) test per unit to be recorded by a trained operator. The maximum allowable displacement per blow is 15mm to a dept of 0.5m deep.
- Minimum reinforcement for concrete Ref. 245 (200 x 200 x 6.3 mm) SANS 1024:2012 welded steel mesh
- 25 Mpa Concrete mixes must be supplied by an approved ready mix concrete supplier.
- Concrete must be vibrated to expel entrapped air.
- Broom finish of the concrete

3.3.4. WIRE / CABLE MANAGEMENT

- Wire management with cable trays

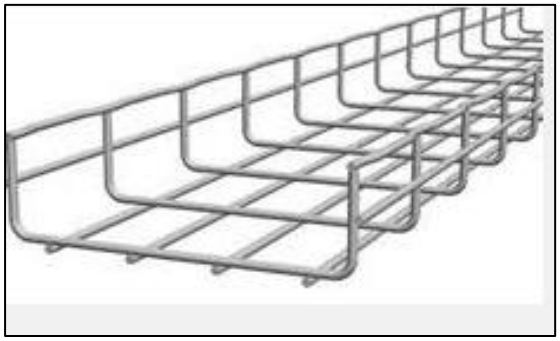


FIGURE 3-6: WIRE MESH

3.3.5. SERVICE PLAN

Once works completion has been received for the entire project, the contractor will make provision for a 12-month maintenance period. This maintenance will include all maintenance activities required for the system and equipment to perform as intended and reach the required design lifetime. Equipment maintenance will include all regular maintenance that the installation must undergo at specific periods, like changing filters. The contractor will need to arrange access to the site with the client and will need to align maintenance activities with the client's operational requirements.

All services shall be carried out by person who hold valid Air conditioning and refrigeration certificate or certificate in safe handling of refrigerant from a recognized institution. Verifiable proof of registration (Certificate/card) as Air conditioning/ Refrigeration

Technician or Certificate in Safe handling of Refrigerant shall be submitted with this bid. Tenderer shall provide a list of competent registered name/names that will be made available to perform any duties for and on behalf of the bid on this contract

3.4.LOCK AND DOORS

- All doors and locks, etc must be of industrial standard.
- Replace door lock, complete with strike plate, mortise lock, chrome plated handles and door stop. SABS Approved:
- All doors, door frames and window frames must be clean, dry, firm and dust free, painted with similar or equal to one coat merit universal undercoat (UC1) (before glazing) and apply two coats of paint similar to Plascon Velvaglo to manufacturer's specification. Colour by Engineer.
- All the doors must be in good working condition

3.5.SAFETY GATE

3.5.1. GENERAL SPECIFICATION FOR MANUFACTURING OF GATES

- No gap between 2 frames must be larger than 5 mm.
- Min steel thickness of all steel is 2 mm. Bars is solid 16mm steel
- All work to be with strait and corners 90 degrees where require.
- All grinding marks must be sand down with a flap disk # 60 (mounted on angle grinder).
- Remove all welding splatters.
- All steel dents to be fill up with body butty and sanded down.
- Where wall paint & plaster is damaged, repair area with Pollyfilla (or similar) and paint to match surrounding.
- All Rawl bolts must be welded to the steel frame. The only way the bolt could be removed is by grinding.
- All metal to be clean, dry and dust free, painted with one coat red oxide base etching primer and apply two coats of enamel black. Paint to manufacturer's specification.

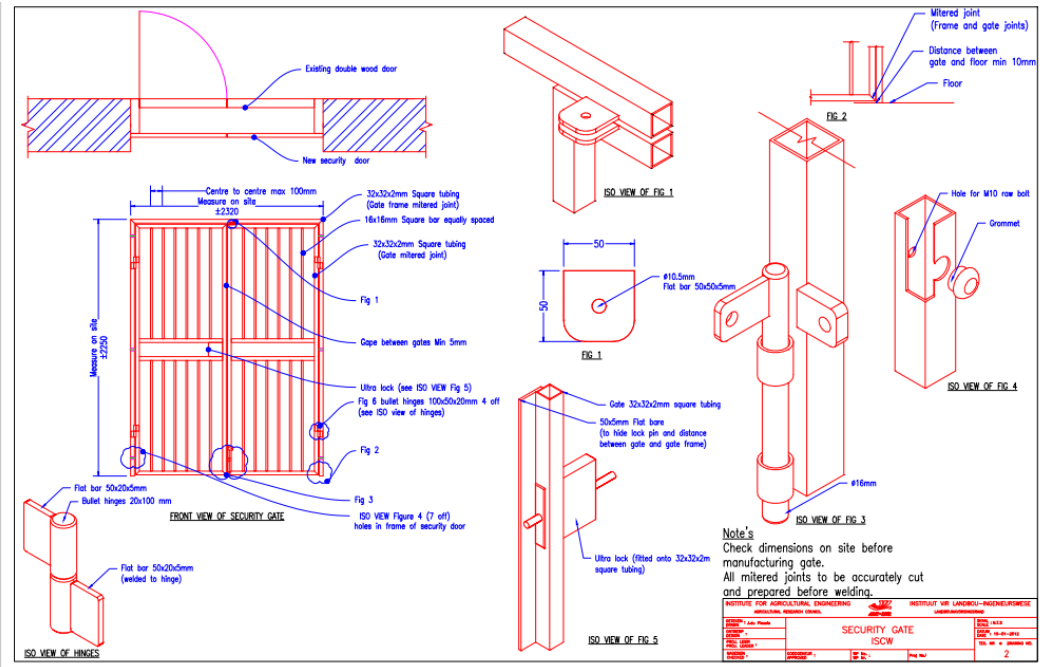


FIGURE 3-7: SECURITY SYSTEM

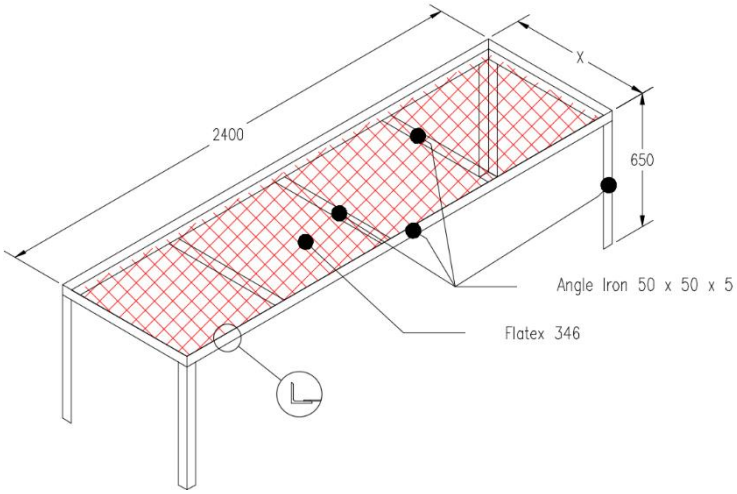
3.6.CONCRETE FLOOR

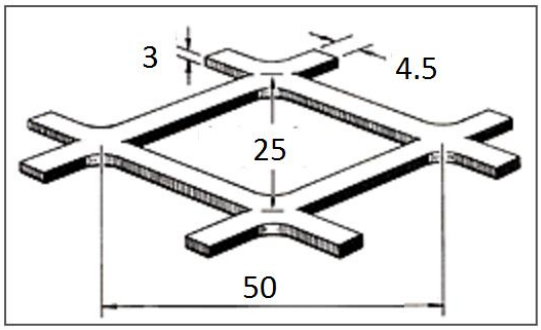
All surfaces should be free from laitance, dust, and other contamination, dry to 75% RH, and free from rising dampness and groundwater pressure. The primed surface should be treated with a solvent-free concrete primer and base coat, followed by a homogeneous concrete sealant. Application must be in accordance with approved applicators, ensuring proper sloping towards the drainage outlets

- Final floor level must be 100 mm above natural ground level
- All compactions by the contractors must be tested with a minimum of two (2) successful Dynamic Cone Penetrometer (DCP) tests per unit to be recorded by a trained operator. The maximum allowable displacement per blow is 15mm.
- Floor must be slope to the outside 1:100
- REF 200 to be installed.
- 20 Mpa Concrete Ready mix with a thickness of minimum thickness of 80 mm to be used.
- Concrete Certificate to be handed over to the ARC
- Steel floating surface finish

3.7.STEEL TABLES

- Frame manufactured from angle iron 0.05 x 0.05 x 0.005 m.
- Angel Iron table frame must be invers.
- Legs manufactured from angle iron 0.05 x 0.05 x 0.005 m.
- Sand blasting and hot dip galvanizing after manufacturing
- Work area covering - Flatex 346.





3.8.FIRE EXTINGUISHERS

- Portable fire extinguishers, SANS 1567 & SANS 1910.
- Two 9 kg or 9 Litre fire extinguishers per house complex (Total 8 for this tender)
- Appropriate signage must be mounted on the wall next to fire extinguishers.

3.9.DESIGN

Electrical, Structure and HVAC must be designed and signed off by a professional engineer, register at ECSA.

3.10. PVC CEILING MATERIAL

- Anti-fungal
- Termite proof
- Fire retardant (Classification of B/B1/B2 SANS 428)
- Minimum width of panels 250mm
- Minimum thickness of panels 7mm
- Colour of panels and trimmings: White Matt
- Existing Ceiling branding structure must be used.
- Screw all panels with a minimum of 6x30mm wood screws.
- All holes and crevices must be sealed with white silicon.
- No screws must be visible.
- Install strictly according to manufacturer instructions.

3.11. TRELLIS SUPPORT SYSTEM

- ARC is open to alternatives suggestions.
- Hot dipped wires

- The design should not interfere with other compartment systems like irrigation, lights or climate control systems.
- Height above floor: 1.5 – 1.8m
- 250mm wide above each table (i.e. 2 rows per compartment)
- 5mm wire, 50 x 50 openings
- Cable tray will also curry the growth lights on the undersides.

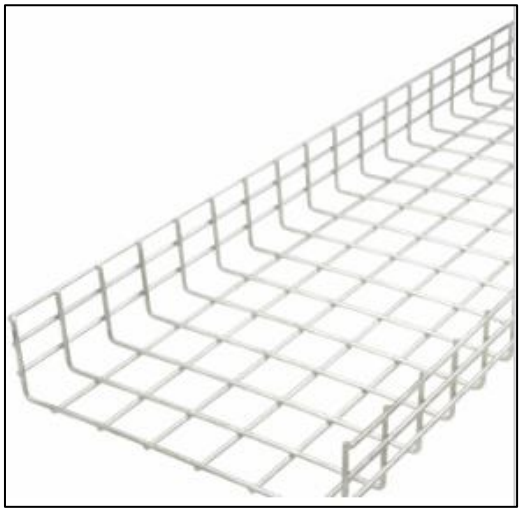


FIGURE 3-8: TRELLIS SUPPORT

3.12. IRRIGATION

The irrigation must be design by an irrigation expert and present to the ARC Engineer for approval.

- Control by Irrigation controller (Computer)
- Minimum one zone (Station) per room
- Each pot must have own drippers 2L/hour.
- 60 pots per room on two tables (2 supply lines)
- Wi-Fi equip.
- Display on the computer.
- All pipes must be not in the pathway of the trollies or human traffic.
- The design must include a main line water filter system.

3.13. ALTERNATIVE WATER SUPPLY

3.13.1. WATER TANK

- Capacity 5000 liter
- No tank stand needed.
- Manufactured from food grade LLDPE plastics
- UV Resistant & BPA free prevents algae growth
- Secure child-safety lids
- Black inner liner – prevents algae growth.
- Supplied with 50/40mm yellow tank connectors at the bottom and top

- Tank must be fill with permeant installed ball valve
- Supplied with strong sealed tank connectors
- 10 year warranty
- Anker to the cement slab with 4 galvanize cables and turn buckles

3.13.2. BASE FOR WATER TANK

- Compacting of soil. Minimum of two (2) successful Dynamic Cone Penetrometer (DCP) test per unit to be recorded by a trained operator. The maximum allowable displacement per blow is 15mm to a dept of 0.5m deep.
- Concrete floor of 200 mm thickness must be cast.
- A minimum of 1m larger than the tank mut be cast around the structure (Veld fires)
- Slightly slope away from the structure (1:100)
- Minimum reinforcement for concrete Ref. 245 (200 x 200 x 6.3 mm) SANS 1024:2012 welded steel mesh
- 25 Mpa Concrete mixes must be supplied by an approved ready mix concrete supplier.
- Concrete must be vibrated to expel entrapped air.
- Broom finish of the concrete
- The placing of concrete must be done to maintain the quality and uniformity, and, once the concrete has been placed and vibrated, it is necessary to protect it from drying out and extreme of temperatures. It must also be cured to maintain a satisfactory moisture content and temperature in the concrete during early stages so that the desired properties may develop.

3.13.3. WATER PUMP SYSTEM

- The correct pump motor combination must be designed by the irrigation designer to deliver the correct water flow and water pressure to the irrigation system for optimal performance of the irrigation system. The pump must be protected from weather elements and theft.
- Water Pressure to be that standard municipal pressure estimated at 400kPa

3.14. SERVICE WATER.

- Install a new galvanized 25 mm water reticulation system for each compartment.
- Supply and install one 25 mm brass bib tap per compartment (SABS approved and similar or equal to Cobra).
- Height of tap, 1 m from ground level.

- Ten meter long, 20 mm diameter hose-pipe for each glasshouse complete with brass cap and lining and clamp (tap connector), with a six year warranty

3.15. PURIFIED WATER SYSTEM

- An in-line filtration unit will be required to remove or kill microbes from the irrigation water.
- UV System
- 110Watts sterilizer
- Flow rate: > 5400 LPH
- Lamp x2 (Length): 925mm
- Housing Material: Stainless steel 304
- Inlet/outlet connections, 1" or 25.4mm
- 2 spare lights for each unit

3.16. FOOT BATH

A foot bath will be required to reduce the risk of contamination and ensure a high level of sanitation by cleaning the footwear of all individuals entering the greenhouse.

- Corrosion-resistant material to withstand constant exposure to water and sanitizing chemicals.
- Adequate size to accommodate at least one person stepping in fully and wide enough to accommodate a lab trolley (0.6 x 1m).

PHOTO: TYPICAL FOOTBATH

3.17. AIR CURTAIN

An air curtain will be required to create an air barrier between the exterior air and the conditioned interior air of the greenhouse. The air curtain will also prevent the infiltration of cold or hot air, bugs, fumes, humidity, dust and debris.

- Location
  - Corridor
    - Mounted at the main entrance of the greenhouse corridor.
- Dimensions
  - Span the full width of the door entrance.
- Blower capacity
  - Sufficient to create a downward air stream that covers the entire entrance.
- Functionality
  - The air curtain needs to activate automatically upon door opening.

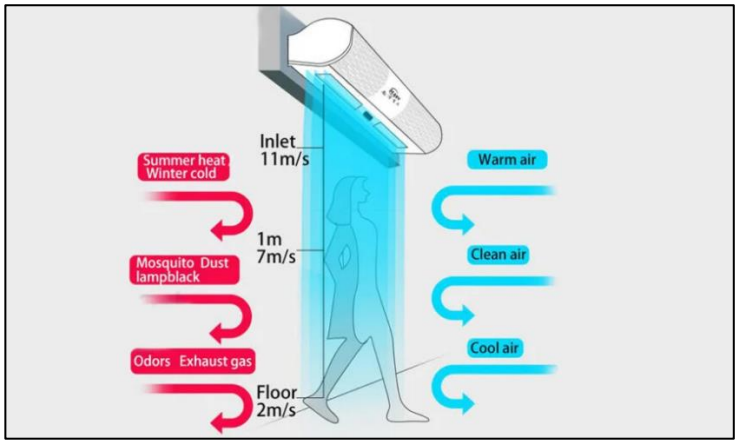


FIGURE 3.9: ILLUSTRATION OF AN AIR-CURTAIN.

4. NAME BOARDS

- Full-color printing material: 1.4 mm chromadek (CKS 191 standards)
- Size of sign: A2
- Chromadek, printed at 300 dpi on a monomeric vinyl sticker
- Mounted with galvanized bolts
- The Chromadek label shall have a minimum guaranteed life of 10 years
- ARC will provide the Artwork in a Microsoft Word format
- Quantity: 10
- Mounting of Name boards on Buildings
- Name boards to be the same as existing ones (attached to buildings)

FIGURE 4-1: EXAMPLE OF AN ARC NAME BOARD

5. PRICING DATA

5.1 – PRICING INSTRUCTIONS

The Tenderer shall provide a fully itemised bill of quantities, complete with item prices. The bill of quantity shall include at least the following items and allocations:

- Engineering costs
- Preliminaries
- Site establishment
- Site clearing and demobilisation
- Full equipment list broken down into the following levels of detail:
  - Cost of equipment (itemised)
  - Cost of freight
  - Installation cost.
- Provision for spares
- Provision for manuals
- Provision for all taxes applicable to the execution of the Works, including import duties.

The Bill comprises items covering the Contractor's profit and costs of general liabilities and of the Upgrading of Temporary and Permanent Works.

Descriptions in the Bill of Quantities are abbreviated and may differ from those in the Standardized and Project Specifications. No consideration will be given to any

claim by the Contractor submitted on such a basis. Should any requirement of the measurement and payment clause of the appropriate Standardized or Project Specification(s) be contrary to the terms of the Bill, the requirement of the appropriate Standardized, Project, or Particular Specification as the case may be, shall prevail.

The "Occupational Health and Safety Act No 85 of 1993" Construction Regulations are as follows:

- A payment item in the schedule of Quantities / Bill of Quantities must allow the contractors to price for compliance with OHSA and the Construction Regulations.

5.1.1 – PAYMENT SCHEDULE

The Tenderer shall provide a payment schedule.

5.1.2 – BILLS OF QUANTITIES / SCHEDULE OF QUANTITIES

Please note that it is mandatory to submit a complete Priced Bills of Quantities with the Returnable Documents.

Items	Quantity required	Price/Unit	Price (Excl VAT)
1. Shop drawing (as built) of the greenhouse complex			R
2. Renovating			R
3. Climate control system			R
4. Irrigation systems			R
5. Growing systems & trellis support			R
6. Lights			R
7. 1 Year service plans for HVAC and all control systems			R
8. Tables			R
9. Alternative water supply			R
10. Name boards			R
11. Contingency at 10%			R
Total (excl of Vat)			R
Total (Incl of Vat			R

APPENDIX A: GREENHOUSE B5 CONCEPT LAYOUT